SEROPREVALENCE OF VIRAL HAEMORRHAGIC FEVERS IN TANZANIA: STRENGTHENING SCIENTIFIC CAPACITY FOR SURVEILLANCE AND RESPONSE

INVESTIGATORS AND COLLABORATING INSTITUTIONS

Principal Investigator
Leonard E.G. Mboera, PhD, Southern African Centre for Infectious Disease Surveillance-Africa Centre of Excellence in Infectious Disease of Human and Animals (SACIDS-ACE) (formerly with the National Institute for Medical Research), Principal Investigator

Co-Investigators
1. Gerald Misinzo, PhD, SACIDS-ACE, Sokoine University of Agriculture
2. Susan F. Rumisha, PhD, National Institute for Medical Research
3. Calvin Sindato, PhD, National Institute for Medical Research
4. Mark Rweyemamu, PhD, SACIDS-ACE, Sokoine University of Agriculture
5. Francis Mhimbira, PhD, Ifakara Health Institute
6. Sima Rugarabamu, PhD Candidate, Muhimbili University of Health and Allied Sciences
7. Joo-Yeon Lee, PhD, Div. Emerging Infectious Diseases & Vector Research, National Institute of Health, Korea CDC
8. Athanas D. Mhina, MPhil, National Institute for Medical Research, Tanzania

Collaborating Partnership
This is a collaborative research project between Tanzania through Southern African Centre for Infectious Disease Surveillance- Africa Centre of Excellence for Infectious Diseases of Humans and Animals (SACIDS-ACE) in Eastern and Southern Africa and Korea National Institute of Health (KNIH). The collaborating Institutions are:
- National Institute for Medical Research (NIMR), Tanzania
- Sokoine University of Agriculture (SUA), Tanzania
- Ifakara Health Institute (IHI), Tanzania
- Muhimbili University of Health and Allied Sciences (MUHAS), Tanzania
- Korea National Institute of Health, South Korea

SUMMARY

Background: Viral haemorrhagic fevers (VHFs) refer to a group of illnesses that are caused by several distinct families of viruses. The term VHF is used to describe a severe multisystem syndrome characterised by an overall vascular system damage. Although no clinical cases of Ebola, Marburg or Yellow fever have been reported in Tanzania, its geographical position puts the country at high risk. With no known cure for all VHFs, the health systems rely on prevention and control strategies to contain new outbreaks. Early detection and diagnosis is a key trigger effective response to infectious disease epidemics.

Broad Objective: Strengthening capacity for surveillance and preparedness against viral haemorrhagic fevers in Tanzania. Specifically, the study aims to: (i) To develop and/or assess a genomics driven near-field based (multiplex) diagnostic system for surveillance of potentially high risk VHFs (Ebolavirus, Marburg, RVF, CCHF, Yellow fever and Arenaviruses) in Tanzania; (ii) To undertake a risk assessment of factors that increase the probability of incursion of VHF pathogens into Tanzania; (iii) To carry out clinical evaluation of diagnostic
tools developed under Objective 1 in areas identified as high risk by the risk assessment of Objective 2; (iv) To build capacity through training of staff in the wide application of molecular and serological technologies, and their derivatives, as tools for primary analysis of diagnostic samples; (v) To assess community knowledge and livelihood practices that influence prevalence and acquisition of VHFs in Tanzania.

**Methods:** The study will involve all five ecological zones in Tanzania. The districts to be involved include Buhigwe, Kalambo, Kyela, Kinondoni, Kilindi, Mvomero, Kondoa, and Ukerewe. Mapping of the ecological zone will be done. All age groups individuals, except those less than 9 months of age will be sampled. Sampling will be done within the complete household which is selected and no household will be replaced if the residents are not found to be at home. Individuals will be asked to provide a blood sample. A total of 5-19 ml of blood will be collected from adults and children >10 years by venipuncture and one to three mls will be collected from children ≥9 months and ≤10 years of age also by venipuncture. Information on socio-demographic characteristics (age, sex, occupation, village, workplace, residence) will be collected for each subject. History including recent history of febrile illnesses, and other risk factors will be ascertained for all participants. Clinical parameters will be documented. The study-related questionnaires will be completed for each consented and assented subject who will then formally enrolled into the study using unique identification code that will restrict direct identification of individuals. All specimens will be processed at the Genome Centre at the Sokoine University of Agriculture laboratory in Morogoro, Tanzania.

**Outcomes:** The expected outcomes include: (i) Enhanced capacity for risk analysis of the potential for incursion of an emerging/re-emerging disease in Tanzania; (ii) Enhanced research and diagnostic capacity to detect and identify viral hemorrhagic fevers by sharing research resources including specimens; (iii) Enhanced virological capability within the Tanzanian public health systems; (iv) Institutional collaboration between Korea and Tanzania strengthened; and (v) Policy and practice support guidance provided through research evidence.

This is a three-year project estimated to cost USD 195,000.

**BACKGROUND**

Viral hemorrhagic fevers (VHFs) refer to a group of illnesses that are caused by several distinct families of viruses. The term VHF is used to describe a severe multisystem syndrome characterised by an overall vascular system damage. Viral hemorrhagic fevers include the following diseases: Alkhurma hemorrhagic fever, Argentine hemorrhagic fever, Bolivian hemorrhagic fever, Chapare hemorrhagic fever, Crimean-Congo hemorrhagic fever (CCHF), Ebola virus disease (EVD), Hantavirus Pulmonary Syndrome, Hemorrhagic fever with renal syndrome, Hendra virus disease, Kyasanur Forest Disease, Lassa fever, Lujo hemorrhagic fever, Lymphocytic choriomeningitis, Marburg hemorrhagic fever (MHF), Nipah virus encephalitis, Omsk hemorrhagic fever, Rift Valley fever (RVF), Sabia-associated hemorrhagic fever, Tick-borne Encephalitis and Venezuelan hemorrhagic fever. While some types of hemorrhagic fever viruses can cause relatively mild illnesses, many of these viruses cause severe, life-threatening disease. Most of the hemorrhagic fever viruses are classified as biosafety level four (BSL-4) pathogens.
The VHF diseases which have been reported in Sub-Saharan Africa include EVD, Marburg, Lujo, RVF, Lassa fever and Yellow fever. EVD has several times, occurred in the Democratic Republic of the Congo (DRC) and Uganda (Rosello et al., 2015) and recently in Guinea, Sierra Leone and Liberia (Nyenswah et al. 2014, 2015; Scarpino et al. 2015). Yellow Fever outbreaks have been reported from Uganda, Kenya, DRC and Angola in recent years (http://wwwnc.cdc.gov/travel/notices/watch/yellow-fever-democratic-republic-of-the-congo; http://www.who.int/features/2016/yellow-fever-angola/en/). In Africa, outbreaks of Marburg haemorrhagic fever (MHF) have been reported in Angola, DRC, Kenya, South Africa and Uganda (http://www.who.int/csr/don/). Rodent borne zoonotic viral haemorrhagic fevers, including Lujo Virus have been reported in South Africa and Zambia (Briese et al., 2009). Lassa virus outbreaks have been reported from West African countries (Mylen, 2005) with frequent outbreaks in Nigeria. RVF outbreaks have frequently been reported in East Africa. Between 1930 and 2007, a total of 10 RVF outbreak waves were reported in Tanzania (Sindato et al., 2014). The CCHF, which is primarily transmitted to people from ticks and livestock is endemic in Africa, and has been reported in Egypt, Ethiopia, Mauritania, Senegal, Burkina-Faso, Benin, Nigeria, Central African Republic, DRC, Kenya, Uganda, Madagascar, Zimbabwe, Namibia, South Africa, Madagascar and Tanzania (Swanepoel, 1995; Swanepoel et al., 1987). Of all the VHF known to-date, Ebola has been the most important disease of global security concern. Ebola was first discovered in 1976 in Central Africa, the worst outbreak happened between 2014-2016 when the virus rapidly spread through West African countries of Liberia, Sierra Leone and Guinea, killing more than 11,000 men, women and children. During this period, cases of Ebola were also reported in Mali, Nigeria, Senegal, Spain, Italy, the United Kingdom and the United States.

Although no clinical cases of Ebola, Marburg or Yellow fever have been reported in Tanzania, its geographical position puts the country at high risk. With no known cure for all VHFs, the health systems rely on prevention and control strategies to contain new outbreaks.

RATIONALE

Early detection and diagnosis is a key trigger to effective response to infectious disease epidemics. Most often, delays in early detection and specific diagnosis has resulted into national and international coordinated responses to Ebola and RVF epidemics being marshalled late when the epidemic curves were at or beyond the peak (Coker et al 2011). A recent experience impact of delays in early detection and diagnosis is the Ebola epidemic in West Africa that resulted in over 10,000 human deaths (Epstein, 2016). The international response to the outbreak was marshalled when the disease was already out of control and causing health and humanitarian crises (Nouvellet et al., 2015; Epstein et al., 2015). A similar situation was recently experienced for the yellow fever epidemic in Angola (Grobbleaar et al. 2016). Where a clinical syndrome has been recognised, the absence of specific differential diagnosis has often resulted in inappropriate responses. Yet there are examples in Africa where early recognition and specific diagnosis resulted in prompt and effective response (Briese et al., 2009; Shoemaker et al., 2011; Muyembe-Tamfum et al., 2012).

Diagnostics including point-of-care for VHFs have been or are being trialled in different parts of the world. For implementation of VHFs diagnostic trials and related research it is necessary
to inform on their suitability in Tanzania. Information related to characteristics of pathogens, therefore, needs to be established.

In Tanzania, international health regulations are implemented through integrated disease surveillance and response (IDSR) strategy. IDSR utilizes traditional surveillance methods based on health facility clinical cases, developed mainly for the control of transmission of infections and early detection of known outbreaks. Although Tanzania has in place a surveillance system for VHF (MoHSW, 2011), the performance and its effectiveness for early detection and timely response is limited. It is critical for a good surveillance system to also incorporate other sources of information such as laboratory, systematic surveys and research data.

A recent capability gap analysis for VHF fever pathogen surveillance in Tanzania, which was undertaken by the Southern African Centre for Infectious Disease Surveillance (SACIDS) – Africa Centre of Excellence for Infectious Diseases of Humans and Animals (SACIDS-ACE) involving its national partner institutions, namely the National Institute for Medical Research, Muhimbili University of Health and Allied Sciences, Sokoine University of Agriculture, Catholic University of Health and Allied Sciences and Ifakara Health Institute, revealed a relative weakness in the capacity for systematic surveillance for evidence of viral activity (sub-clinical infection) with VHF associated viruses, when compared with Uganda, the DRC and South Africa.

GOAL AND OBJECTIVES

Project Goal
Establishment of research base centre in Africa through international collaborative research for VHF's jointly spearheaded by the Korean National Institute of Health and Tanzania institutions that form the core of the SACIDS Africa Centre for Infectious Diseases in Eastern and Southern Africa.

Broad Objective
Strengthening capacity for surveillance and preparedness against viral haemorrhagic fevers in Tanzania.

Specific objectives
1) To develop and/or assess a genomics driven near-field based (multiplex) diagnostic system for surveillance of potentially high risk VHF’s (Ebolavirus, Marburg, RVF, CCHF, Yellow fever and Arenaviruses) in Tanzania;
2) To undertake a risk assessment of factors that increase the probability of incursion of VHF pathogens into Tanzania;
3) To carry out clinical evaluation of diagnostic tools developed under Objective 1 in areas identified as high risk by the risk assessment of Objective 2;
4) To build capacity through training of staff in the wide application of molecular and serological technologies, and their derivatives, as tools for primary analysis of diagnostic samples;
5) To assess community knowledge and livelihood practices that influence prevalence and acquisition of VHF’s in Tanzania
METHODS

Study areas
Tanzania is grouped into five ecological zones (Figure 1). These zones are defined based on the variation on rainfall, vegetation, temperature land use and elevation. For instance, areas with forest rain are expected to have heavy vegetation which might include non-human primates who act as common reservoirs for some of the VHFIs. Human-primate interactions are common in such locations and compound to the risk of attaining the infections. Climatic features also differentiate human movements, economic activities, types of vegetation which influence the risk. Hence risk assessment needs to consider the relations between climatic and environmental conditions for optimal estimation of the population vulnerability to VHFIs.

A multistage cluster design will be utilized in selecting study sites/districts. The initial stage will involve identifying distinct ecological zones in the country based on rainfall pattern, vegetation and altitude, which will be used to account for differences in humidity, temperature, and land cover use. The country will be divided into five distinct zones based on vegetation and land cover (normalized difference vegetation index, NDVI), rainfall (NDVI and number of wet days per month) and elevation:

- **Zone 1**: Western parts of the country with tropical forest and some elevated areas and unimodal rainfall pattern, and altitude <2,300m above sea level. The study districts will comprise of Buhigwe (Kigoma) and Kalambo (Rukwa).
- **Zone 2**: Include part of the Southern-highland districts with areas with high precipitations, and areas with tropical forest and bimodal rainfall pattern, and elevation >2,300 m. Kyela district will be considered in the study.
- **Zone 3**: North-eastern part of the country, some elevated areas >2,300m, with bimodal rainfall pattern. Kinondoni (Dar es Salaam) and Kilindi (Tanga) districts will be considered in the study.
- **Zone 4**: Central part of the country, moderate precipitation and unimodal rainfall pattern. The study districts will be Mvomero (Morogoro) and Kondoa (Dodoma).
- **Zone 5**: Lake Victoria zone, characterised by with bimodal rainfall pattern. Ukerewe Islands will be included.

After mapping the distinct ecological zones, a random point generator in ArcGIS (ESRI, Redland, CA) will be used to randomly pick at least one location per zone to sample. Using the latitude and longitude of each randomly selected point, the closest town and village to that point will be identified using GoogleEarth. Multidisciplinary teams will be sent to each location to sample humans. The teams will consist of: physicians, ecologists, epidemiologists, virologists and laboratory personnel.

Sample size estimates
The study sites will include Buhigwe (Kigoma), Kalambo (Rukwa), Kyela (Mbeya), Kinondoni (Dar es Salaam), Kilindi (Tanga), Mvomero (Morogoro), Kondoa (Dodoma) and Ukerewe (Mwanza). Seroprevalence of VHF in the study areas is not known explicitly. Based on the ecological and environmental heterogeneity in the study areas the sample size is calculated independently for each zone. With the desired absolute precision of 5% and confidence level of 95% the estimated sample size per zone will be 384. The sample size is adjusted by the
design effect of 2 to account for the clustering effect in the study design and then a contingency of 30% is added to account for non-responses and refusal resulting to a sample size of 999 per zone. Therefore the sample size for 5 zones will be 4,995. Attempt will be made to recruit equal number of males and females. All age groups individuals, except those less than 9 months of age (potentially considered to have maternal derived immunity against VHF), will be sampled.

**Human sampling**

All age groups individuals, except those less than 9 months of age, will be sampled. When the team arrives in the study site, an assessment will be done to determine the location and average size of households in the area/village. The number of samples taken in the will be stratified by population. A random number generator will be used to select specific households to sample. Sampling will be done within the complete household which is selected and no household will be replaced if the residents are not found to be at home. Thus a degree of oversampling will be conducted to ensure adequate sampling.

Individuals will be asked to provide a blood sample. Five to ten milliliters (mls) of blood will be collected from adults and children >10 years by venipuncture and one to three mls will be collected from children ≥9 months and ≤10 years of age also by venipuncture. All specimens will be collected by the trained phlebomist on the field team and will be collected using standard sterile technique. Blood will be collected from willing subjects after a written consent is obtained. Two attempts will be done to take the blood samples. In addition, basic demographic information will be collected from each individual bled and recorded in a line list by a member of the field team and will include: age, sex and history of travel from the residence in recent period.

**Data collection**

**Clinical and epidemiological information**

Information on socio-demographic characteristics (age, sex, occupation, village, workplace, residence) will be collected for each subject. History including recent history of febrile illnesses, and other risk factors will be ascertained for all participants. Clinical parameters will be documented. The study-related questionnaires will be completed for each consented and assented subject who will then formally enrolled into the study using unique identification code that will restrict direct identification of individuals.

**Specimen collection and processing**

Traditional clinical specimen for diagnosis of viral haemorrhagic fever is primarily sera. However, to verify the applicability of non-blood samples to the molecular diagnostic kits to used, other types of clinical samples, including saliva, urine and semen will be collected wherever possible. Serum samples from each participant will be labeled, archived, frozen, stored at −80°C, and transferred to research central laboratory, for the case were blood cannot be obtained crevicular fluid from oral cavity will be collected. Crevicular fluid is the component of oral fluid contain plasma IgG and IgM which transude from capillary bids in gingival crevices between teeth and gums. All specimens will be collected by trained phlebomist in accordance with standard operating procedures. The specimens will be labelled using a unique study identification number that also appears on the questionnaire. Samples will be immediately stored in cool boxes, dry shippers or frozen at -196 °C in liquid nitrogen.
Extra care will be observed to make sure that specimens kept at 4°C in cool boxes are transported to the research laboratory within 72 hours, analyzed by the diagnostic laboratory methods, and promptly frozen at -80°C or colder. Frozen specimens shall be transported to the laboratory in liquid nitrogen dry shippers at least once in two weeks for testing. A separate laboratory investigation form containing the same unique identification number will accompany specimens.

**Specimen packaging and transportation**

Study sites will be provided with cool boxes and dry shipper(s) for transporting samples to the laboratory. Liquid nitrogen container(s) will be provided for local storage of samples, replenishments of liquid nitrogen and for charging dry shippers. Packaging specimens will be according to transportation safety standards. Within Tanzania, specimens will be transported to the laboratory via ground transport. For laboratory procedures which require facilities i.e. BSL4, which is not available in the country, the samples will be shipped to partnering institution in South Korea. For air shipping samples packaging shall meet the World Health Organization and International Air Transport Association (IATA) requirements which involve a triple-layered system to protect specimens from damage and protect carriers from inadvertent exposure to infectious materials.

**Laboratory safety**

All laboratory specimens will be handled with appropriate safety precautions including those outlined below:

a. Only staff trained in the safe handling of infectious substances (potentially or confirmed) and diagnostic reagents will be employed.

b. Viral Haemorrhagic fever vaccines (those available) will be made available to all staff.

c. Access to the laboratory is restricted.

d. Personal protective effects, including laboratory coats and gloves are worn in the laboratory at all times when handling samples or reagents.

e. Samples entering the laboratory will be first handled in a BSL-3 facility (Iso Arc) before further processing in a BSL-2 with Class 2 biosafety cabinets.

f. Unidentified virus isolates are handled in Class 2 biosafety cabinets with staff wearing lab coats and disposable aprons, double gloves and either a HEPA disposable face mask or a HEPA filter North Full-Face respirator.

g. All contaminated laboratory materials or spills are disinfected in 2% Lysol/Virkon solution and autoclaved prior to leaving the laboratory for incineration.

h. Solid wastes (gloves, disposable masks, aprons) are placed in autoclave bags for autoclaving prior to incineration.

i. Sharps will be placed in plastic sharps-containers appropriately located within the laboratory and will be incinerated regularly.

**Specimen storage**

Specimens will be transported from the field to research laboratories by trained health workers following the standard procedures. All specimens will be stored within a locked ultra-low freezer at the Sokoine University of Agriculture laboratory in Morogoro, Tanzania. The samples will remain in ultra-low freezer storage for the life of the study initially anticipated to be five years, plus an additional ten years. At that time, the specimens will either be destroyed or will be transferred to a specimen repository under the guidance and
approval of the appropriate regulatory bodies. A copy of the study samples will be shipped to Korea National Health Institute for further testing complying with the Tanzania Material Transfer Agreement (MTA) regulations (http://www.nimr.or.tz). Material transfer forms will be filled and submitted for approval by the Medical Research Coordinating Committees when such samples have been identified.

**Development and assessment of genomic-based diagnostic tools for VHF**

For an effective VHF surveillance system to be timely, it must be performed as near to field sites as possible using robust procedures that can be readily performed in African laboratories. Standard polymerase chain reaction (PCR)-based methods are laborious, costly and time-consuming. We will implement a simple and robust sampling pipeline that exploits molecular diagnostics for VHF pathogens, which will enable timely detection and energize the collection of genomic data to understand the circulation of VHF viruses in Tanzania. Focusing on Ebola virus, Marburg virus, RVF virus, CCHF virus and Arenaviruses we will provide field or near-field diagnostic tools that can be used in situ to rapidly confirm disease suspicion, and a pragmatic approach to generate informative sequence data for molecular analyses. Our strategy is to ensure and allow continued surveillance in the field by developing appropriate laboratory methods and tailor-made bioinformatics tools, training of African researchers in their use and expand the collaborative network in Africa.

**Reverse transcription loop-mediated isothermal amplification (RT-LAMP) and lateral flow assays**

Rapid detection of viruses in the field will be achieved using RT-LAMP assays or lateral flow devices where available. The isothermal (single-temperature amplification) tests have high analytical sensitivity, are tolerant to inhibitors so that simple sample preparation methods can be used, and can be performed using inexpensive and easy-to-use equipment. In these field settings, these assays will be complemented by the use of lateral-flow devices that have been developed under Southern African Centre for Infectious Disease Surveillance (Changula, 2014).

**Real time Viral Genomes Sequencing**

The project will employ the pocket-sized portable MinION (Oxford Nanopore) sequencing technology that utilize disposable flow cells [http://biorxiv.org/content/early/2015/01/27/011940]. A similar approach has used this technology to characterise Ebola viruses collected during the recent outbreak in West Africa (Quick et al., 2016) and Zika virus in Brazil (Faria et al., 2016). We will use this platform to conduct sequencing of viral genomes direct from clinical samples using methods (multiplex pool primer design, multiplex PCR, sequencing on Minion, bioinformatic analysis and quality control) previously described by Quick et al. (2017). Re-sequencing will be conducted for verification using deoxyxynucleotide cycle sequencing amplification after RT-PCR. RT-PCR assays will be established to amplify genomic fragments that are appropriate for subsequent sequence analyses.

**ELISA**

Serologic testing will be done for all samples; initial screening by IgG to each of the viruses will be done followed by IgM testing of all IgG-reactive samples. IgG and IgM testing for Ebola virus, Marburg virus, RVF virus, CCHF virus and Arenaviruses will be done by using cell
culture–derived antigens. Briefly, the ELISA antigens used to coat plates (for IgG) or detect captured IgM produced by infecting Vero E6 cells with respective reference virus strains or by using uninfected cells for control. Each samples will be tested at 4 dilutions (100, 400, 1,600, and 6,400). IgG reactivity/IgM nonreactivity will be considered as evidence of past infection; concurrent IgG/IgM reactivity will be interpreted as infection within the previous 6 months. IgG-seropositive persons without any histories of illness will be considered to have had subclinical or very mild infection.

Realtime RT-PCR
One of the rapid and accurate detection methods of virus from clinical sample is Real time RT-PCR. Its high sensitivity and specificity is important to control and manage public health events. Therefore, evaluation on Real time RT-PCR method developed by Korea National Institute of Health (NIH) to detect virus causing viral haemorrhagic fevers will be conducted. It can detect VHFs related viruses such as Ebola, Marburg, Lassa, Crimean-Congo haemorrhagic fever, Rift valley, Yellow fever, and Hantan virus. For this, on-site evaluation test and training by Korea NIH staffs will be carried out. Protocols will be developed in Korea in Year 1 and African researchers trained in their use prior to deployment for near-field VHF screening. This will provide baseline information on VHF prevalence and viral characterisation at a variety of sites that will inform future sampling strategies.

Laboratory Capacities
All laboratory work in Tanzania will be carried out at Sokoine University of Agriculture (SUA). Molecular Biology Research Laboratory at SUA is equipped with Class II biological safety cabinets; a 7500 Applied Biosystems Fast real time PCR systems, a GeneAmp 9700 and 3 Veriti ABI for conventional PCR, Field Laboratory System (Enigma Diagnostics) for fully automated combined nucleic acid extraction and real-time PCR, A 3500 Applied Biosystems Genetic Analyser for automated dideoxy cycle sequencing of PCR products, Conventional and a nanodrop spectrophotometers for determining quality and quantity of DNA, gel documentation systems for visualization of electrophoresed PCR products, Ultralow freezers (-80 °C), freezers (-20 °C), refrigerators (+4 °C) for storage of reagents and cryopreservation of samples, and ELISA washers and readers for serology and an ice maker.

There is a Conventional Virology Laboratory for vaccine development, and diagnostic testing. This is a modern cell culture based biosafety level 2 research laboratory equipped with biological safety cabinets, light and fluorescence microscopes, CO2 incubators and ultralow freezers. The laboratory has an IsoArk BSL-3 laboratory. The laboratory is finalization the installation of a Next Generation Sequencer by the end of 2017. Moreover, the SACIDS provides links to the South African Centre for Emerging and Zoonotic Diseases of the National Institute for Communicable Diseases (NICD), giving access to the large Biosafety Level 4 laboratory and expertise for safe handling of dangerous pathogens.

ETHICAL ASPECTS

Ethical approval
The proposal will be submitted to the Medical Research Coordination Committee of the National Institute for Medical Research, Tanzania, for ethical approval. Upon approval, the study will be carried out adhering to the approved protocols. The study and its objectives will
be introduced to relevant authorities in the study areas. During data collection, the study objectives and procedures will be explained to each subject and/or guardian in Kiswahili (national language), and they will be made aware that participation in the study is on voluntary basis and their identity would be kept confidential. A written informed consent will be obtained from participants. If the subject or guardian is illiterate, the investigators will read the consent to them and the subject will be requested to provide thumb print. No samples will be taken until informed consent is obtained. A copy of the consent form will be provided to the subject (Appendix 1 and 2).

Participants will be free to respond or refuse to respond to any question, and accept or reject blood sampling, and will be free to stop their participation in the study at any time without any penalty on such a decision. Participant identity will be masked by use of coded identity numbers (IDs), instead of their names. Confidentiality and anonymity of the study participants will be emphasized and maintained throughout the study. A unique code will be used to link the questionnaires and laboratory results, and this unique code will be kept separately with their names. No information concerning the study or the data or blood samples will be released to any unauthorized person. Electronic data will be password protected and stored into password protected computers with limited access to only authorized personnel.

Project physician and laboratory technician(s) trained by the study will be involved in the subject clinical examination and sample collections, respectively. A copy of the study samples will be shipped to Korea National Health Institute for further testing complying with the Tanzania Material Transfer Agreement (MTA) regulations (http://www.nimr.or.tz).

**Potential Risks and Benefits**

It is not anticipated that the blood collection procedure will contribute any additional physical or psychological risks for the study population as standard operating procedures will be adhered to. Project physician and laboratory scientists/technicians trained by the study will be involved in the subject clinical examination and sample collections, respectively.

Regarding potential benefits of study, there would be no direct benefits to the study participants. However, the results will consolidate important information to the Ministry of Health and the Government of the United Republic of Tanzania as regards to the burden and detection of VHF in the country. The project will also result improved surveillance of the VHF in the country.

Nucleoside analogue inhibitors of the cell-encoded enzyme S-adenosylhomocysteine hydrolase have been shown to inhibit VHFV replication therefore supportive care and early post exposure interferon beta therapy will be provided to those who will test positive.

**Confidentiality**

Subject confidentiality is strictly held in trust by the participating investigators, their staff, and the sponsor(s) and their agents. This confidentiality will include testing of biological samples, in addition to household surveys. The study protocol, documentation, data, and all other information generated will be held in strict confidence. The study personnel will not
release any information concerning the study or the data to any unauthorized third party without prior written approval of the lead Institution. Records relating to individual participation in the study will remain private. Individual’s names will not be used in any report resulting from this study. All files and laboratory specimens will have only a unique identification number, not the subject or subject’ name. All project staff will be trained to work with human subjects. All data and information will be collected and stored securely. Collected samples and associated epidemiological data will be stored in secured place with access only to authorised personnel.

Informed Consent Process
Informed consent process will be initiated prior to the individual’s agreeing to participate in the study and continuing throughout the individual’s study participation. Extensive discussion of risks and possible benefits of participation in this study will be provided to the subjects and their families. Consent forms describing in detail the study procedures and risks will be given to the subject. The consent forms to be used will be the ones approved by the Medical Research Coordinating Committee and the subject will be asked to read and review the document. Upon reviewing the document, the investigator will explain the research study to the subject and answer any questions that may arise. The subjects will sign the informed consent document prior to being enrolled in the study. The subjects may withdraw consent at any time throughout the course of the study. A copy of the informed consent document will be given to the subjects for their records. The rights and welfare of the subjects will be protected by emphasizing to them that the quality of their medical care will not be adversely affected if they decline to participate in this study.

The community will be engaged through their village government. Community meetings will be held to sensitize and engage the study population. However, individual informed consent will be obtained from each adult individual. In case of children, informed consent will be sought from parents/guardians, and each child will have to give its assent. Subjects, parents, and legal guardians may indicate their consent by signing or marking the form with a thumbprint.

OUTCOMES

The project will result into:
1) Enhanced capacity for risk analysis of the potential for incursion of an emerging/re-emerging disease in Tanzania;
2) Enhanced research and diagnostic capacity to detect and identify viral haemorrhagic fevers by sharing research resources including specimens
3) Enhanced virological capability within the Tanzanian public health systems;
4) Institutional collaboration between Korea and Tanzania strengthened
5) Policy and practice support guidance provided through research evidence

DATA MANAGEMENT AND ANALYSIS

Data processing and quality control
Separate databases will be developed for quantitative and qualitative data. Qualitative data from the serosurvey will be entered in EpiData v.3.1 by qualified data clerks. The
epidemiological data and laboratory results for specific VHFes will be entered into a pre-
developed database and then imported into statistical software for coding, cleaning and
statistical analysis. A sample of 10% will be re-entered by a different set of clerks for quality
control.

Descriptive statistics and univariate association testing
This will be conducted by calculating necessary summary statistical measures including
frequency distribution, percentages, tabulation and so forth. Graphical displays such as charts, bars, will be employed to relevant variables. Statistical tests such as chi-square, Fisher's exact, t-test and one-/two- sample proportional tests will be performed to compare
the proportion of specific VHF seropositivity outcomes between individuals within and across
study zones. Furthermore, chi-squared tests will be used to assess the association between
the proportion of seropositivity and the potential risk factor variables: anthropogenic,
ecological and climate-related factors. The seropositivity rates and locations of visited
households will be mapped using ArcGIS (ESRI East Africa) to study distribution and identify
geographical clusters.

Model fitting and selection of the best model
Statistical modelling techniques will be employed to accurately estimate the association
between these factors and VHF risk and to identify potential factors. A mixed effects logistic
regression modelling will be used to investigate the association between various potential
risk factors and VHF seropositivity outcomes. The models will include household as a random
effect variable to account for dependence of data from the same household. The ecological
zone will be set as the stratification variable, and will be forced into the model as fixed effect
variable. To take account of possible nonlinear effects of continuous-scale risk factors
on the logit form of the outcome variable, these variables will be categorised into three contiguous
groups, each representing a third of the observations.

Specifically, univariate analysis will be performed to identify predictors to be included in the
multivariate model at a cut-off of a p-value of ≤ 0.20. The statistically significant variables
from univariable analysis will be included in a mixed effects multivariable logistic regression
analysis based on a forward variable selection approach, and will be screened on the
potential effect in the model using the likelihood ratio statistic at a cut-off of p-value ≤ 0.05. A
factor will be considered to have potential confounding effect if its inclusion in the model
results in a change of ≥25% in the coefficient estimates of other risk factors compared to its
absence. In case confounding effect is found subgroup analyses will be performed. Variables
not statistically significant in the univariable analysis, but with a known association with VHF
or suspected to have potential confounder effect, will also be evaluated in the multivariable
analysis. In the pre-screening process of the association between variables, only one of the
two variables with significant collinearity will be included in the model based on its biological
plausibility with regard to specific VHF. Presence of effect modification will be examined by
introducing the interaction terms into the model. After identifying potential attributes, a
logistic regression analysis will be used to evaluate and quantify the key drivers of the VHF
risk. Analysis will consider variation in the risk, predictors and vulnerability between zones.
Statistical analysis will be performed using Epi-Info (Atlanta, GA), SAS (Cary, NC) software or
any other suitable statistical package. Statistical significance will be tested at 5% level.
Goodness of fit of the model will be assessed using standard methods (Hosmer & Lemeshow,
The discriminatory ability of the final model will be assessed using receiver operating characteristic curves (ROC), and will be quantified using the area under the curve (AUC).

**VHF Vulnerability**

A variable defining vulnerability to VHF infection and risks of transmission for individuals will be created using estimation from the best model. This index will be calculated and given a score based in the magnitude of the effect estimated from the model. Difference between ecological zones, socio-demographic features of individual or their communities live in and other relevant identified factors will be determined to guide development of the surveillance tool. Smooth maps which describe spatial distribution of VHF risk in Tanzania will be produced and discussed.

**Development of the surveillance diagnostic system/tools**

Results of the best model will again be used as a basis for development of surveillance diagnostic system and tools. Core variables for the system will include significant variables considering the strength of their effect and factors found with interaction or confounding effect for VHF risk. The strength of the effect of the random parameters (on households) will be used to decide the level of surveillance focus that include also effect within strata (ecological zones). This tool will be used for rapidly assessment in selected communities to identify suspected cases of which will be tested for confirming presence of any VHF pathogens using the RT-LAMP assays explained earlier. This will be tested in different settings to evaluate its performance and be revised accordingly.

**DISSEMINATION**

Knowledge translation and publication will be part of the dissemination strategies. Meetings and workshops will be conducted to provide fora for knowledge translation and sharing exercise involving mass media, to make sure information generated is shared widely. Results will be shared in national and international scientific conferences to reach a wider scientific community and also published in peer-review journals. Important information for public health will be provided immediately to the Ministries of Health and the World Health Organization. Evidence (policy) briefs will be developed and shared with policy makers.

Detailed formal publication will be a joint activity involving all Tanzanian and Korean collaborators, and will seek approval from the National Institute for Medical Research (Tanzania).

**PREVIOUS EXPERIENCES IN SIMILAR RESEARCH WORKS**

The research team members have demonstrated expertise in effectively applying interdisciplinary methods in epidemiological surveillance studies in Southern Africa region, and the entire project team has long-running collaborations of this nature. Much of this expertise has been acquired through active participation of the members in various research studies as indicated by their curriculum vitae.

Team members Leonard Mboera, Gerald Misinzo, Calvin Sindato, Francis Mhimbira have been involved in several studies on emerging and re-merging diseases, including Rift Valley fever.
and Dengue in Tanzania. Susan Rumisha has immense experiences in handling research “big” data from several research projects. Calvin Sindato and Susan Rumisha have immense experience in statistical modelling of infectious diseases.

### BUDGET SUMMARY (in US$)

<table>
<thead>
<tr>
<th>Category</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>9,500</td>
<td>9,500</td>
<td>9,500</td>
<td>28,500</td>
</tr>
<tr>
<td>Supplies (Kits, Tips, Tubes, etc.)</td>
<td>15,000</td>
<td>15,000</td>
<td>15,000</td>
<td>45,000</td>
</tr>
<tr>
<td>Travel (attendance at conferences)</td>
<td>6,500</td>
<td>7,000</td>
<td>10,500</td>
<td>24,000</td>
</tr>
<tr>
<td>Others (Research and training expenses)</td>
<td>24,250</td>
<td>24,300</td>
<td>23,300</td>
<td>71,850</td>
</tr>
<tr>
<td>Equipment</td>
<td>6,500</td>
<td>6,000</td>
<td>3,500</td>
<td>16,000</td>
</tr>
<tr>
<td>Indirect Costs (&lt;5% of total costs)</td>
<td>3,250</td>
<td>3,200</td>
<td>3,200</td>
<td>9,650</td>
</tr>
<tr>
<td>Total (direct plus indirect)/year</td>
<td>65,000</td>
<td>65,000</td>
<td>65,000</td>
<td>195,000</td>
</tr>
</tbody>
</table>

### PROJECT TIMELINE, 2017-2020

<table>
<thead>
<tr>
<th>Activity</th>
<th>2017 (monthly)</th>
<th>2018 (quarterly)</th>
<th>2019 (quarterly)</th>
<th>2020 (quarterly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submission and approval by Ethics Committee</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finalization of the survey protocol including site selection, plan of work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logistics and administrative arrangements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team recruitment and training</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collection of clinical samples</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and assess genomics diagnostic surveillance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk assessment of factors that affect VHF pathogens</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess community knowledge and practices that influence VHF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data management and analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Build capacity in application of molecular and serological technologies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of the preliminary report</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Publications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in Local and International conferences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workshop for research project evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


APPENDIX I: INFORMED CONSENT
SEROPREVALENCE OF VIRAL HAEMORRAGIC FEVERS IN TANZANIA:
STRENGTHENING SCIENTIFIC CAPACITY FOR SURVEILLANCE AND RESPONSE

SOKOINE UNIVERSITY OF AGRICULTURE (SUA)
P.O Box 3015, Chuo Kikuu, Morogoro, Tanzania
Tel: +255 23 264 0037; +255 787 011 677

Participant’s Consent Statement
The following statement will be read to all individuals asked to participate in the survey.

My name is ………………………., and I am working for the National Institute for Medical Research (Tanzania)/Sokoine University of Agriculture/Muhimbili University of Health and Allied Sciences in collaboration with the Korean National Health Institute. We are carrying out a study to establish the risk of Viral Haemorrhagic Fevers in Tanzania. It is your free choice to be part of your study. The results of the survey will lead to a better understanding of the risk of VHF in our country.

A trained laboratory technologist will describe to you about the collection of blood and urine for testing of VHF viruses. He/she will seek your permission to collect the specimen from you. She/he will ask for 5mls-10mls of blood which he/she will take from your hand using a syringe and needle. The blood specimen will be taken to a laboratory at Sokoine University of Agriculture in Morogoro and tested for VHF viruses. If it is found to be positive then the specimen will be shipped to a laboratory in Korea for further testing and approval. The results of the test will be kept confidential.

There is the possibility of mild discomfort, bruising and very rarely infection at the site where the blood is taken. But, should you be injured as a direct result of participating in this survey, you will be provided with medical care at a local public health facility at no cost.

You are free to choose to be part of this survey. However, if you accept to take part in this study, there will be no payment to you. The facts about you from this survey will be kept confidential as directed by the Laws of the United Republic of Tanzania. No names will be used on any of the survey reports, publications or presentations. Only we, the researchers, will ever see the surveys with people’s names. If you choose not to participate in this study, that is fine too. You will not be treated differently by the health personnel in this area. You may ask the researchers any questions you have at any time.

Do you wish to participate? YES; NO (Please circle)

Signature ________________________

If you have any questions regarding this research, you may ask the research staff or contact Dr. Leonard Mboera, Leader, Emerging and Vector-borne Diseases, Southern African Centre for Infectious Disease Surveillance, P.O. Box 3297, Morogoro, Tanzania; Telephone: +255 754 314701; E-mail: lmboera@gmail.com

If you have questions about your rights as participant in this research, please contact the chairperson of the National Health Research Ethics Review Committee of the National Institute of Medical Research, at 255 22 2121400.
KIAMBATANISHO 1A: TAMKO LA RIDHAA
UTAFITI KUHUSU MAGONJWA YASABABISHAYO UVUJAJI WA DAMU MWILINI
NCHINI TANZANIA: KUJENGA UWEZO WA UFUATILIAJI NA UDHIBITI

SOKOINE UNIVERSITY OF AGRICULTURE (SUA)
SACIDS Africa Centre of Excellence for Infectious Diseases of Humans and Animals in Eastern and Southern Africa
College of Veterinary Medicine and Biomedical Sciences
P.O Box 3015, Chuo Kikuu, Morogoro, Tanzania
Tel: +255 23 264 0037; +255 787 011 677

Taarifaifuatayotasonkwakilamshiriki (umrimiaka ≥18) katikautafitihuu.


Mtaalamu wa maabara atakuelezea kuhusu zoezi hili na viashiria vyakuwepo maambukizi ya damu kiasi cha mililita 5-10 kutoka mkononi mwako kwa kutumia sindano maulam. Sampuli hiyo ya damu itapelekwa maabaraya Chuo Kikuu cha Sokoine cha Kilimo kwa uchunguzi wa kitaalamu. Kama kutakuwa na viashiria vyakuwepo maambukizi ya virusi, sampuli zitapelekwa kwenye maabara yenye uwezo mubadiliko wazimulika wazikuwa wa kwenye wawu吾ende la kama hilo. Matokeo ya uchunguzi wawakekana kutoka kwenda hivyo na hivyo kuisawiriwa serikali ya kithibiti magonjwa ya milipuko.

Kitendo cha utoaji damu kinaweza kuleta usumbufu au kusababisha maumivu kidogo. Kama hilo litatokana, utapewa huduma katika kutafuta uwezo vya afya kwa bila malipo.

Uko huru kushiriki katika utafiti huu. Iwapo utakubali kushiriki, hakutakuwa na malipoy oyote. Taarifa zako zote zitahifadhiwa kwa usiri mkubwa kama sheria za Jamhuri ya Muungano wa Tanzania.

Majinayawashirikiliwotekatufactifihuu, ujumbe uwezo wa kuthibiti magonjwa ya binadamu wa Magonjwya Binadamu, S.L.B 3297, Morogoro, Tanzania; Simu: +255 754 314701; Barua pepe: Mboera@gmail.com

Je uko radhi kushiriki? NDYO; HAPANA (Zunguishia jibu lilolewa)

Sahihiyamshiriki

Kama kunamaswalliyoutekuhusutafithi, unaweza camouflage Taafiti Mkuu Dkt. Leonard Mboera wa wa Kituo cha Ufutiaji wa Magonjwa Kusini ma W Afrika, S.L.B 3297, Morogoro, Tanzania; Simu: +255 754 314701; Barua pepe: Mboera@gmail.com

Kama unahitaji kuuliza maswali kuhusu haki zako kama mshiriki wa utafiti, basi wasiliana na Mwenyekiti wa Kamati ya Taifa ya Maadili ya Utafiti wa Afya, Taasisi ya Taifa ya Utafiti wa Magonjwa ya Binadamu kwa simu Na. +255 22 2121400.
APPENDIX 2A: CHILD ASSENT FORM
SEROPREVALENCE OF VIRAL HAEMORRAGIC FEVERS IN TANZANIA:
STRENGTHENING SCIENTIFIC CAPACITY FOR SURVEILLANCE AND RESPONSE

SOKOINE UNIVERSITY OF AGRICULTURE (SUA)

SACIDS Africa Centre of Excellence for Infectious Diseases of
Humans and Animals in Eastern and Southern Africa
College of Veterinary Medicine and Biomedical Sciences
P.O Box 3015, Chuo Kikuu, Morogoro, Tanzania
Tel: +255 23 264 0037; +255 787 011 677

Child assent statement: The following statement will be read to all children under the age of 18 requested to participate in the survey.

My name is ……………………………., and I am working for the Sokoine University of Agriculture/National Institute for Medical Research/Muhimbili University of Health and Allied Sciences in collaboration with the Korean National Health Institute. We are carrying out a study to establish the risk of Viral Haemorrhagic Fevers in Tanzania. It is your free choice to be part of the study. The results of the survey will lead to a better understanding of the risk of VHF in our country.

A trained laboratory technologist will describe to you about the collection of blood and urine for testing of VHF viruses. He/she will seek your permission to collect the specimen from you. She/he will ask for 5-10mls of blood which he/she will take from your hand using a syringe and needle. The blood specimen will be taken to a laboratory at Sokoine University of Agriculture in Morogoro and tested for VHF viruses. If it is found to be positive then the specimen will be shipped to a laboratory in Korea for further testing and approval. The results of the test will be kept confidential. There is the possibility of mild discomfort, bruising and very rarely infection at the site where the blood is taken. But, should you be injured as a direct result of participating in this survey, you will be provided with medical care at a local public health facility at no cost.

You are free to choose to be part of this survey. However, if you accept to take part in this study, there will be no payment to you. The facts about you from this survey will be kept confidential as directed by the Laws of the United Republic of Tanzania. No names will be used on any of the survey reports, publications or presentations. Only we, the researchers, will ever see the surveys with people’s names.

If you sign this paper, it means that you have read this and that you want to be in the study. If you don’t want to be in the study, don’t sign this paper. Being in the study is up to you, and no one will be upset if you don’t sign this paper or if you change your mind later.

Your signature (Child): _______________________________ Date _____________
Your name: ___________________________________________ Date _____________
Signature of person obtaining consent: _________________________ Date _____________
Name of person obtaining consent: ___________________________ Date _____________

If you have any questions regarding this research, you may ask the research staff or contact Dr. Leonard Mboera, Leader, Emerging and Vector-borne Diseases, Southern African Centre for Infectious Disease Surveillance, P.O. Box 3297, Morogoro, Tanzania; Telephone: +255 754 314701; E-mail: lmboera@gmail.com

If you have questions about your rights as participant in this research, please contact the chairperson of the National Health Research Ethics Review Committee of the National Institute of Medical Research, at 255 22 2121400.
KIAMBATANISHO 2B: TAMKO LA KUKUBALI KUSHIRIKI
UTAFITI KUHUSU MAGONJWA YASABABISHAYO UVUJAJI WA DAMU MWILINI
NCHINI TANZANIA: KUJENGA UWEZO WA UFUATILIAJI NA UDHIBITI

SOKEINE UNIVERSITY OF AGRICULTURE (SUA)

SACIDS Africa Centre of Excellence for Infectious Diseases of Humans and
Animals in Eastern and Southern Africa
College of Veterinary Medicine and Biomedical Sciences
P.O Box 3015, Chuo Kikuu, Morogoro, Tanzania
Tel: +255 23 264 0037; +255 787 011 677

Taarifa ifuatayo itasomwa kwa kila mtoto mshiriki (umri miaka <18) katikautafitihuu.


Mtaalamu wa maabara atakuelezea zoezi hili na kuuza ni maambukizi ya damu kiasi cha miliili 5-10 kutoka mkononi mkubwa kwa kutumia sindano maalum. Sampuli hiyo ya damu itapeleeka maabaraya Chuo Kikuu cha Sokoine cha Kilimo kwa uchunguzi wa kitaalamu. Kama kutakuwa na viashiria vyakawepo maambukizi ya virusi, sampuli zitapelekwa kwenye maabara zenye uwezo mkubwa zaidi huko nchini Korea. Matokeo ya uchunguzi wa kimaabara yatahifadhiwa kwa usiri mkubwa.


Sahihi ya mtoto: ___________________________ Tarehe _____________
Jina la mtoto: ___________________________ Tarehe _____________
Sahihi ya Mtoa Ridhaa (Mzazi/Mlezi): ___________________________ Tarehe _____________
Jina la Mtoa Ridhaa: ___________________________ Tarehe _____________

Kama kunamaswaliyo data kuhusu utafiti huu, unaweza kufanana na Dkt. Leonard Mboera wa Kituo cha Ufuatilaji wa Magonjwa Kusini mwa Afrika, S.L.B 3297, Morogoro, Tanzania; Simu: +255 754 314701; Baruapepe: lmboera@gmail.com

Kama unahitaji kuuliza maswali kuhusu haki haki, basi wasiliana na Mwenyekiti wa Kamati ya Taifa ya Maadili ya Utafiti wa Afya, Taasisi ya Taifa ya Utafiti wa Magonjwa ya Binadamu kwa simu Na. +255 22 2121400.
UTAMBULISHO WA KAYA

Jina la Wilaya: ________________________________

Jina la kijiji: ________________________________

Jina la kitongoji: ________________________________

Namba ya kaya: ________________________________

Jina la mtafiti: ________________________________

Tarehe ya mahojiano: ______________

Muda wa kuanza mahojiano: ________________
## I: DEMOGRAFIA

**1. Jaza taarifa kwa mwana kaya katika kaya hii:**

<table>
<thead>
<tr>
<th>SN</th>
<th>1a. Jina</th>
<th>1b. Jinsi</th>
<th>1c. Umri</th>
<th>1d. Uhusiano na mkuu wa kaya:</th>
<th>1e. Ndoa</th>
<th>1f. (Kwa Mwanamke wa umri wa miaka 15-49) Je ni mjamzito?</th>
<th>1g. (Kana umri cha 0)</th>
<th>1h. (Kana umri cha 0)</th>
<th>1i. (Kana umri cha 0)</th>
<th>1j. (Kana umri cha 0)</th>
<th>1k. (Kana umri cha 0)</th>
<th>1l. (Kana umri cha 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>2</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>3</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>4</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>5</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>6</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>7</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>8</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>9</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>10</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>11</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
<tr>
<td>12</td>
<td>1 2</td>
<td>____ -9</td>
<td>1 2 3 4 5 6 7 8 9 10 -9</td>
<td>1 2 3 4 5 6</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
<td>1 2 - 9</td>
</tr>
</tbody>
</table>

* Mhojiwa
2. Kwa kila mjumbe wa nyumba iliyochaguliwa kwa utafiti dodosa yafuatayo: (Jaza Vitambulisho na majina kutoka sehemu ya 1)

<table>
<thead>
<tr>
<th>SN</th>
<th>Jina</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a.</td>
<td>Katika kipindi cha mizizi mitatu iliyoopita, je mwanakaya (jina) alipatwa na homa kali?</td>
</tr>
<tr>
<td>2b.</td>
<td>Ni matukio mangapi ya homa mwanakaya (jina) alipata kwa mizizi mitatu iliyoopita? (Jaza Vitambulisho na majina kutoka sehemu ya I)</td>
</tr>
<tr>
<td>2c.</td>
<td>Tukio la mwisho la homa liliidumu kwa siku ngapi kwa (jina):</td>
</tr>
<tr>
<td>2d.</td>
<td>Kwa tukio la mwisho dalili zipo pia (jina) alikuwa nazo? (Usisome majibu zungupatia yote atakayotaja)</td>
</tr>
<tr>
<td>2e.</td>
<td>Katika kipindi cha miezi mitatu iliyoopita (jina) alisafiri nje ya kijiji au wilaya hii?</td>
</tr>
</tbody>
</table>

(Kama hakuna aliyeugua katika kaya, nenda 2e)

| 1* | 123456789 |
| 2  | 123456789 |
| 3  | 123456789 |
| 4  | 123456789 |
| 5  | 123456789 |
| 6  | 123456789 |
| 7  | 123456789 |
| 8  | 123456789 |
| 9  | 123456789 |
| 10 | 123456789 |
| 11 | 123456789 |
| 12 | 123456789 |

* Mhoojiwa
APPENDIX 3: CURRICULUM VITAE

LEONARD E.G. MBOERA

Biodata
Surname: MBOERA
First and middle names: Leonard Ernest Gustavin
Phone (work): +255 22 212 1 400
Mobile phone: +255 754 314 701
E-mail: lmboera@nimr.or.tz; lmboera@gmail.com
Country of birth: Tanzania
Place of birth: Moshi, Tanzania
Date of birth: November 21, 1957
Sex: Male
Nationality (birth): Tanzanian

Professional expertise
Several years of experiences in research in mosquito-borne diseases, ecohealth, outbreak management, infectious disease surveillance and health systems.

University Education
1. 1995-1999, PhD (Chemical Ecology of Mosquitoes), Wageningen Agricultural University, The Netherlands
2. 1989-1991, Diploma of Imperial College (Applied Entomology), Imperial College of Science, Technology & Medicine, London, United Kingdom
3. 1989-1990, MSc (Applied Entomology), University of London, UK
4. 1982-1985, BVM (Veterinary Medicine & Surgery), Sokoine University of Agriculture, Morogoro, Tanzania

Current Institutional Affiliation
SACIDS-African Centre of Excellence in Infectious Diseases of Human and Animals, College of Veterinary Medicine and Biomedical Sciences, Sokoine University of Agriculture, P.O. Box 3297, Chuo Kikuu, Morogoro, Tanzania

6. "One stone two birds". Integrating application of biolarvicides and fertilizer in rice fields to control malaria vectors productivity and increase rice yields in Tanzania. Grand Challenges Canada (Co-Principal Investigator); Sept 2014-March 2016. CAD 100,000
7. Epidemiological, clinical and entomological investigation of Dengue infection in Dar es Salaam: understanding the circulation of dengue virus and the vector abundance and transmission indices. Tanzania Commission for Science and Technology; National Institute for Medical Research; Ministry of Health and Social Welfare; National Institute for Infectious Diseases "L. Spallanzani", Rome (Principal Investigator), 2014. TSh 62m
8. Control of the filariasis vector, Culex quinquefasciatus using biolarvicide and oviposition attractant-treated breeding sites in Mafia Islands, eastern Tanzania. Grand Challenge Canada (Co-Principal Investigator), 2013-2014. CAD 100,000
9. Integrated Research Partnerships for Malaria Control through an Ecohealth Approach in East Africa. International Development and Research, Canada (Principal Investigator), 2011-2013. CAD 110,000
10. Implementation Science to Optimize Malaria Vector Control and Disease Management. National Institute of Health (Co-Principal Investigator), 2010-2016. USD 491,000
13. Integrated Malaria Mosquito Control: Field evaluation for Olyset® window and eave curtains and door screens in malaria holoendemic area Tanzania, 2009-2011 (Principal Investigator). USD 80,000
14. Challenges and opportunities for the involvement of traditional practitioners in scaling up safe male circumcision in Tanzania, 2009. World Health Organization (Principal Investigator)
17. Insecticide treated mosquito net utilisation and coverage in Tanzania (Norvatis Aventis/UNDP), 2007-2008 (Principal Investigator)
18. Epidemiology of Avian Influenza in Tanzania (University of Minnesota/ USAID), 2006-2008 (Co-Principal Investigator)

Consultancies
3. Regional contingency plan for epidemics due to communicable diseases, conditions and other events of public health concern for the East African Community. EAC/ECSA, April-June 2015.
5. Assessment of the Availability of Health Services of the Required Mix at Various Levels of the Health System to Ensure Accessibility and Quality of Health Care including the Change
of Burden of Diseases Resulting from Climate Changes and Environment (Ministry of Finance and Economic Affairs, Tanzania, 2009-2010)


Journal publications (Total articles=131; Average per year=5)

Selected Research Journal Articles


GERALD MISINZO

Personal History
1.1.1 Name: Gerald Misinzo
1.1.2 Sex: Male
1.1.3 Date of birth: January 02nd, 1975
1.1.4 Place of birth: Sengerema
1.1.5 Marital status: Married
1.1.6 Nationality: Tanzanian

Academic Qualifications
1.2.1 Ph.D. in Veterinary Medicine, 2007, Ghent University, Ghent, Belgium.
1.2.2 MSc. Molecular Biology, 2003, Catholic University of Leuven, Leuven, Belgium.
1.2.3 Bachelor of Veterinary Medicine, 2000, Sokoine University of Agriculture, Morogoro, Tanzania

Employment Record at the University
1.3.1 July 2014 to date, Associate Professor
1.3.2 July 2009 to June 2014, Senior Lecturer.
1.3.3 July 2005 to June 2009, Lecturer.
1.3.4 July 2002 to June 2005, Assistant Lecturer.
1.3.5 September 2000 to June 2002, Tutorial Assistant.

Professional activities
Member of the British Journal of Virology Editorial Board, Smith and Franklin Academic Publishing Corporation. February 2014 to date.
Visiting lecturer, Catholic University College of South-West Flanders, Roeselare, Belgium. March 2009 to date.
Principal investigator, influenza surveillance in Tanzania at PharmAccess Foundation, Dar es Salaam, Tanzania. February 2009 to date.

Teaching
Bachelor of Science in Biotechnology and Laboratory Sciences and Bachelor of Veterinary Medicine.
Master of Science in Molecular Biology and Biotechnology, Master of Science in Applied Microbiology and Master of Science in One Health Molecular Biology.

Supervision of Research

Doctoral students (PhD)
2. Primary supervisor of Tebogo Kgotele, 2014 to date. Molecular characterization and epidemiology of peste des petits ruminants virus in selected areas of Central, Eastern and
Southern Africa. Co-supervising with Dr. Jonas Wensman of Swedish University of Agricultural Sciences, Uppsala, Sweden.

3. Primary supervisor of Fortunate Shija, 2013 to date, Identifying the threats of zoonotic disease emergence in humans from arboviruses of forest wildlife. Co-supervising with Dr. Catherine Walton of University of Manchester, Manchester, UK.

4. Primary supervisor of Gasper Honorati Chiwanga, 2015 to date, Development and evaluation of rapid and reliable assays for testing viability of Newcastle disease virus in vaccines supplied in Tanzania. Co-supervising with Professor Peter Msoffe (University of Dodoma).

5. Primary supervisor of Phanuel Nyimba, 2015 to date, Molecular epidemiology of Rift Valley fever virus in domestic ruminants and mosquitoes during interepizootic periods in Southern Zambia. Co-supervising with Dr. Edgar Simulundu Sikabala (University of Zambia, Lusaka, Zambia).

6. Primary supervisor of Emma Peter Screening, characterisation and complete genome sequencing of sylvatic and outbreak African swine fever virus isolates in selected zones of Tanzania. Co-supervising with Dr. Gabriel Shirima (Nelson Mandela African Institution of Science and Technology; NM-AIST), Prof. Lughano Kusiluka (NM-AIST) and Prof. Sarah Cleaveland (University of Glasgow, UK).

7. Co-supervisor of Reuben Mliwomor Kom Tettey, 2014 to date, Epidemiology of hepatitis E virus infection among pregnant women at Efia Nkwanta regional hospital, Ghana. Co-supervising with Professors Sharadhuli I Kimera (SUA), Mecky Matee (Muhimbili University of Health and Allied Sciences) and Phyllis Addo (Noguchi Memorial Institute Of Medical Research, University of Ghana, Legon).

Postgraduate students (MSc. and MPhil.)


4. Kulus Patrick, 2013-2015, Molecular characterization and surveillance of African swine fever virus in selected wildlife-livestock interface areas of Tanzania, MSc. OHMB,

5. Pendo Vincent Mauya, 2013-2015, Molecular characterisation of African swine fever virus in selected areas of northern and southern Tanzania during 2014 outbreaks, MSc. OHMB,

6. Jonas Thoromo, 2013-2015, Diagnosis and genotyping of 2014 and 2015 outbreak African swine fever viruses in Zambia, MSc. OHMB,

7. Bwihangane Birindwa Ahadi, 2013-2015, Sero-surveillance and molecular diagnosis of peste des petitis ruminants virus in South Kivu, Democratic Republic of Congo, MSc. OHMB,

8. Mariana Shayo, 2013-2015, Diversity of Culiciniae and viral infection in Aedes mosquitoes of Kilombero and Ulanga districts, Tanzania, MSc. OHMB,

9. Kinimi Edson, 2013-2015, Mosquito diversity and febrile illnesses in Karagwe and Kyerwa districts, northwestern Tanzania, MSc. OHMB,

10. Adam Mahamoud Namtimba, 2013-2015, Seroprevalence and genetic characterisation of peste des petits ruminants virus in selected areas of Tanzania, MSc. OHMB,
12. Patience Maindo, 2013-2015, Genotypes of hepatitis B virus among voluntary blood donors in Kinshasa, Democratic Republic of Congo, MSc. OHMB,
13. Ruth Maganga, 2013-2015, Detection of arenaviruses from rodents and shrews in selected wildlife-human-livestock interfaces in Tanzania, MSc. OHMB,
15. David Emil Kwavi, 2013-2015, Molecular diagnosis and discrimination of circulating African swine fever virus during 2013 outbreak in Northern Tanzania, MSc. OHMB,
16. Fidelis Charles, 2013-2015, Analysis of mutation rate of 17 Y-chromosome short tandem repeats loci using Tanzanian father-son paired samples, MSc. OHMB,
17. Godlisten Materu, 2013-2015, Molecular characterization of Wuchereria bancrofti in mosquitoes of Pangani District, North Eastern Tanzania, MSc. OHMB,
18. Issa Nassoro, 2013-2015, Serological and molecular detection of rift valley fever virus in livestock and wildlife of Katavi-Rukwa ecosystem, Tanzania, MSc. OHMB,
19. Kennedy Makola Mbanzulu, 2013-2015, Mosquito diversity and virus infectivity in Kinshasa, Democratic Republic of Congo, MSc. OHMB,
20. Shabani Killiwa Muller, 2013-2015, Seroprevalence of Leptospira infection from agro pastoralist communities in Katavi ecosystem, Tanzania, MSc. OHMB,
22. Jean Pierre Kambala Mukendi, 2013-2015, Detection and molecular characterization of Dirofilaria immitis and Dirofilaria repens in dogs of Morogoro municipality, Morogoro, Tanzania, MBB and
29. Fortunate Shija, 2011-2013, Assessment of milk handling practices and bacterial contaminations along the dairy value chain in Lushoto and Handeni districts, Tanzania.
31. Epaphras Alex Muse, 2010-2012, Molecular characterization of peste des petits ruminants virus and epidemiology of peste des petits ruminants in Southern Tanzania.

Administration
Leader, African Center of Excellence for Infectious Diseases of Humans and Animals in Southern and Eastern Africa (SACIDS-ACE), May 2016 to December 2022.
Head of Department, The Department of Veterinary Microbiology and Parasitology, August 2014 to date.
MSc. One Health Molecular Biology (OHMB) course coordinator, November 2011 to June 2014.

Journal Articles


Projects, consultancies and patents


7. Misinzo G and Malago JJ. 2009-2011. A survey of infectious amphibian diseases affecting free-ranging amphibians inhabiting Kihansi gorge and University of Dar es Salaam compound. Lower Kihansi environmental management project (LKEMP) and National Environmental Management Council (NEMC), World Bank CR 3546-1 - TA. Consultancy number NEMC-LKEMP/PROC/C/05/09. 27,118 USD.


JOO-YEON LEE
Name            Joo-Yeon Lee
Nationality     Korean
Business Address Div. Emerging Infectious Diseases & Vector Research, National Institute of Health, Korea Centers for Disease Control and Prevention, Osongsaengmyeong2-ro, Osong-eub, Cheongju-si, Chungcheongbuk-do 28159, South Korea; (Tel) +82(43)-719-8490 (Fax) +82(43)-719-8519; E-Mail : lylvy@nih.go.kr ; leejooyeon@hanmail.net

Education
Ph. D.          Dept. Biotechnology, Korea University, Seoul, South Korea, 2004
M.S.            Dept. Microbiology, Kon Kuk University, Seoul, South Korea, 1991
B.S.            Dept. Biology, Kon Kuk University, Seoul, South Korea, 1989

Professional Experiences
- Sep 15 2017 - present          Director, Div. Emerging Infectious Diseases & Vector Research, NIH, CDC, South Korea
- May 8 2017 - Sep 14 2017        Deputy Scientific Director, Div. Emerging Infectious Diseases & Vector Research, NIH, CDC, South Korea
- Sep 2005 - May 7 2017           Deputy Scientific Director, Div. Influenza Virus, NIH, CDC, South Korea
- Oct 10 2012 - Oct 2013          Visiting Researcher, Icahn School of Medicine at Mount Sinai, NY, USA

Publication (since 2014)

Research / Project Involvements for viral haemorrhagic fevers (2017):
Principal Investigator, ‘Establishment of research base center in Africa through international collaborative research for viral hemorrhagic fevers’ (Korea CDC)
Co-Investigator, ‘Optimization of highly sensitive molecular diagnosis for detection of viral hemorrhagic fever viruses including Crimean-Congo hemorrhagic fever virus’ (Korea CDC)
Manager, ‘Development of antigen/antibody test kit for viral hemorrhagic fever viruses’ (Korea CDC)

SUSAN F. RUMISHA
Name            RUMISHA, SUSAN FRED
Date/ Place of birth  30th January 1977/ Kahama, Tanzania
Nationality: Tanzanian
Correspondence Address: P.O. Box 681 Tanga, Tanzania
Mobile: +255 68 395 59 02; +255 71 895 59 01
Emails: srumisha@nimr.or.tz; siaeli@gmail.com

Official Current contact:
National Institute for Medical Research (NIMR)
3, Barack Obama Drive, 11101, P.O.Box 9653
Dar es Salaam, Tanzania
Tel: +255 22 2121400; Fax: +255 22 2121360

Profession: Statistician/ Health Information
Broad interests: Health Information Systems, Disease surveillance and Monitoring and Evaluation.

Education

<table>
<thead>
<tr>
<th>University</th>
<th>Degree</th>
<th>Year Attended</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Universität Basel, Switzerland</td>
<td>PhD. Bayesian Statistics</td>
<td>2007 – 2011</td>
</tr>
<tr>
<td>ii. Universiteit Hasselt, Belgium</td>
<td>MSc. Biostatistics</td>
<td>2006 – 2007</td>
</tr>
</tbody>
</table>

Professional/ Employment
1) Statistician, 2001 –2004: Disease Surveillance Program, National Institute for Medical Research, Tanzania
2) Research Scientist (Medical Statistics), July 2004 – June 2012: National Institute for Medical Research, Dar es Salaam, Tanzania
3) Principal Research Scientist (Biostatistics), July 2012 – To date: National Institute for Medical Research, Dar es Salaam, Tanzania

Membership in Medical Association and Other responsibilities
- Tanzania Public Health Association
- Editorial Board Member/ Associate Editor (Statistics), Tanzania Journal of Health Research

Other Professional Training
KAVI-Institute of Clinical Research, University of Nairobi on:
- Certificate in Good Clinical Practice (GCP)
- Certificate in Good Clinical Laboratory Practice (GCLP)

Publications

Dissertation / Theses
Peer Review Journal Publications


CALVIN SINDATO

General information
Name: Calvin Sindato
Employment: Senior Research Scientist (Epidemiology) with the National Institute for Medical Research, Tanzania
Telephone: work: +255 26 260 4219; Mobile: +255 754 056 806; Fax: +255 26 260 4943

Educational qualifications

<table>
<thead>
<tr>
<th>Institution</th>
<th>Year attended</th>
<th>Degree</th>
<th>Area of specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Sokoine University of Agriculture, Morogoro Tanzania</td>
<td>2011-2015</td>
<td>Doctor of Philosophy (PhD) degree</td>
<td>Risk mapping, modelling and prediction of infectious diseases</td>
</tr>
<tr>
<td>(ii) Sokoine University of Agriculture, Morogoro Tanzania</td>
<td>2006-2007</td>
<td>Masters of Preventive Veterinary Medicine (MPVM), GPA: 4.4</td>
<td>Prevention and control of diseases</td>
</tr>
<tr>
<td>(iii) Sokoine University of Agriculture, Morogoro Tanzania</td>
<td>1998-2003</td>
<td>Bachelor of Veterinary Medicine (BVM), Unclassified degree</td>
<td>Veterinary Medicine and Public Health</td>
</tr>
</tbody>
</table>

Publications in scientific peer review journals


Policy briefs prepared and shared with Policy Markers


Cross-cutting research activities


Mentorship to students:


(v) Dr. Lunonu Sigalla. MSc student, Makerere University, 2013-2014. Modelling the factors influencing utilization of cattle dipping services in Kiteto, Tanzania.


5. FRANCINS APOLINARY MHIMBIRA

Ifakara Health Institute, Bagamoyo Research and Training Centre, P. O. Box 74, Bagamoyo, Coast Region, Tanzania.

ORCID ID: orcid.org/0000-0001-8989-6832

Mobile No: +255 754 291657

Education

<table>
<thead>
<tr>
<th>Degree</th>
<th>Institution</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD in Epidemiology</td>
<td>University of Basel (2017), Basel, Switzerland</td>
<td></td>
</tr>
<tr>
<td>Master of Epidemiology (MEpi)</td>
<td>University of Melbourne (2010), Melbourne, Australia</td>
<td></td>
</tr>
<tr>
<td>Doctor of Medicine (MD)</td>
<td>University of Dar es Salaam (2005), Dar es Salaam, Tanzania</td>
<td></td>
</tr>
</tbody>
</table>

Employment history

Work station: Ifakara Health Institute, Tanzania
Date: March 2017-To date: Senior Research Scientist
Date: 2012-February 2017: Research Scientist
A clinical research for TB clinical trials, diagnostic studies and the epidemiological studies on TB and co-infections.
Work station: Kibong‘oto National TB Hospital, Tanzania
2006-2011: Medical Officer
A general medical doctor mainly managing TB and TB and HIV co-infected patients as well as other communicable and non-communicable diseases.

Clinical Research Experience

Principal Investigator and National Coordinating Investigator for 4 IHI, Tanzania
sites in Tanzania for NC-006 STAND Trial (Shortening Treatment by Advancing Novel Drugs): Jan 2015 - to date
Co-Principal Investigator, Tuberculosis Cohort in Dar es Salaam: IHI, Tanzania November 2013 - to date
Co-Investigator, NC-002 Phase II Clinical Trial: June 2012–February 2014
A Phase II Open-Label Partially Randomized Trial to Evaluate the Efficacy, Safety and Tolerability of the combination of moxifloxacin plus PA-824 plus pyrazinamide after 8 weeks of treatment in Adult Patients with Newly Diagnosed Drug-Sensitive or Multi Drug-Resistant, Smear-Positive Pulmonary Tuberculosis.


IHI, Tanzania

Co-Investigator, Tuberculosis Epidemiology and Management in Tanzania (TB-Cohort) June 2012 – September 2013

Grants awarded

Jan 2015 - to date
Principal Investigator for the Phase 3 Open-Label Partially Randomized Trial to Evaluate the Efficacy, Safety and Tolerability of the Combination of Moxifloxacin plus PA-824 plus Pyrazinamide after 4 and 6 months of Treatment in Adult Subjects with Drug-Sensitive Smear-Positive Pulmonary Tuberculosis and after 6 months of Treatment in Adult Subjects with Multi-Drug Resistant, Smear-Positive Pulmonary Tuberculosis.

Funded by Global Alliance for TB drug Development (TB Alliance) and the expected total budget was US $ 1,189,387.50. The STAND trial was stopped due to safety concerns.

November 2014 – February 2016
Principal Investigator for Tuberculosis case finding at the pharmacy using trained pharmacists and an electronically monitored referral system to reduce TB transmission in the community by shortening the diagnosis delay.

Funded by Grand Challenge Canada with a total budget of US $ 112'000

Publications

findings from the Global Burden of Disease 2015 study.


September 2016-To Date: Head of Department - Interventions, Clinical Trials
Responsibilities:
May 2015-To Date: Head of TB research group and Project Leader

Professional Memberships
International Union Against TB and Lung Diseases (The Union)
Member of following Technical Working Group within Ministry of Health
Ministry of Health, Community Development, Gender, Elderly and Children, Dar es Salaam, Tanzania.

6. SIMA ERNEST RUGARABAMU

Sex: Female
Nationality: Tanzanian
Date of Birth: 09.09.1982
Marital status: Married
Number of children: 2; Isaiah, Verdie

Address
Muhimbili University of Health and Allied Sciences, Department of Microbiology and Immunology, P.O. Box 65001, Dar es Salaam, Tanzania.
Telephone: 0713436646
E-mail: sima_luv@yahoo.com

Academic training
Level | Name of School
--- | ---
Primary School Certificate | Mwenge Primary School, 1988-1995
Advanced Level Certificate | Lutheran J Seminary Morogoro, 2000-2002
DDS | Muhimbili University of Health and Allied Sciences, 2003-2008
MSc (Microbiology /Immunology) | Muhimbili University of Health and Allied Sciences, 2012-2015

Posts held
Assistant Lecturer, Muhimbili University of Health and Allied Sciences (MUHAS), Microbiology and Immunology, 2015 – present
Laboratory Coordinator, ABCD/AMR Trials, 2016- 2019
Assistant Laboratory Director, MUHAS-Microbiology Research Lab, 2016- 2017
Research Assistant | Muhimbili University, 01/06/2008 - 30/10/2008
Intern Doctor | Amana Municipal Hospital, 01/11/2008- 15/11/2009
Programme officer | Tanzania Dental Association 20/11/2009 - 30/01/2010
Medical Officer | Muhimbili National Hospital 07/02/2010 - 31/09/2013
Microbiology Resident | Muhimbili National Hospital 1/10/2013 - 30/07/2015

Awards/honors
2. Consultant Microbiologist and Medical Director – Lancet Labs Tanzania, Sept 2017
3. Asst. Lab Director Microbiology-Microbiology Research Lab MUHAS, September 2016
4. Research Lab coordinator -ZNTD/ABCD Trials, 2017- 2019
5. Secretariat of Josiah Kabila University opening, 2008-2010
6. Participant, TRA/Professional forum on fight against drug counterfeit corruption 2010
7. AORTIC 2009 International Cancer Conference, 2009
8. Sahara Company Limited, Best science Student Award, 1999
9. 1st International Youth Leadership Africa Conference, Cape Town, 2007
10. WHO research training and calibration, 2008
11. CPD course on HIV/AIDS, counselling, testing and treatment 2008
12. CPD Training, customer care in oral health service. 2008
13. Global health course Basic medical and Dental science course 2008

Membership and appointments
- Member, Medical Association of Tanzania (MAT), 2008 - present.
- GARP representative on AMR National Action Plan review committee - July 2017

Publications

ATHANAS MHINA
Date of birth: 08th September 1976
Place of birth: Tukuyu, Mbeya
Marital status: Single
Nationality: Tanzanian
Languages: English / Kiswahili (Spoken and Written)
Contact address: National Institute for Medical Research, Tanga Research Centre, P.O.BOX 5004, Tanga
Mobile phone: +255 714 514120
Email address: admhina76@yahoo.com

Academic qualifications
2006–2009: B.Sc (General) (Hons) majoring in Zoology & Applied Microbiology with an upper second class at the University of Dar es Salaam, Tanzania.
2013-2016: MPhil (Virology) at the Sokoine University of Agriculture, Tanzania.

Training
March 2005: ELISA Techniques and Applications organized by the University of Copenhagen at NIMR, Tanga Centre.
April 2006: HIV-1 P24 Antigen assay organized by the University of Copenhagen at NIMR, Tanga Centre.
June 2011: Introductory course in Health Geographic Information System Organized by National Institute for Medical Research
January 2012: Good Clinical Practice (GCP) training course for Investigators at NIMR, Tanga Centre.
February – March 2015: European Mobile Laboratory training at the National Institute for Infectious Diseases “L SPALLANZANI”, ITALY and Bundeswehr Institute of Microbiology, GERMANY. (Laboratory Diagnosis of Ebola and Marburg Viruses using RT-PCR).
Publications


